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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/660,697	09/12/2003	Kevin Andrew Chamness	242662US6YA	7662

22850 7590 06/01/2006

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EXAMINER	
WEST, JEFFREY R	

ART UNIT	PAPER NUMBER
2857	

DATE MAILED: 06/01/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/660,697	CHAMNESS, KEVIN ANDREW	
	Examiner	Art Unit	
	Jeffrey R. West	2857	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 May 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-50* is/are pending in the application.

4a) Of the above claim(s) *43-46,49 and 50* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-42,47 and 48* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *07 November 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on March 29, 2006, has been entered.

Claim Rejections - 35 USC § 101

2. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

3. Claims 1-24, 41, 42, 47, and 48 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Claims 1-24, 41, and 42 are considered to be non-statutory because the claimed invention as a whole must accomplish a practical application. That is, it must produce a "useful, concrete and tangible result." State Street, 149 F.3d at 1373, 47 USPQ2d at 1601-02. The purpose of this requirement is to limit patent protection to inventions that possess a certain level of "real world" value, as opposed to subject matter that represents nothing more than an idea or concept, or is simply a starting point for future investigation or research (Brenner v. Manson, 383 U.S. 519, 528-36,

148 USPQ 689, 693-96); In re Ziegler, 992, F.2d 1197, 1200-03, 26 USPQ2d 1600, 1603-06 (Fed. Cir. 1993)).

Furthermore, a process that consists solely of the manipulation of an abstract idea is not concrete or tangible. See In re Warmerdam, 33 F.3d 1354, 1360, 31 USPQ2d 1754, 1759 (Fed. Cir. 1994). See also Schrader, 22 F.3d at 295, 30 USPQ2d at 1459.

Independent claim 1, and consequently dependent claims 2-18, provides a concluding step of "comparing said at least one statistical quantity to said control limit." This final step of "comparing" does not produce a "useful, concrete and tangible result" but is instead a result of data manipulation. Also, since the resulting comparison is not used for any intended purpose, it appears to be only a starting point for future application. For these reasons, claims 1-18 are considered to be non-statutory.

Independent claim 41, and consequently dependent claim 42, similarly provides a concluding step of "comparing said at least one statistical quantity to said control limit." This final step of "comparing" does not produce a "useful, concrete and tangible result" but is instead a result of data manipulation. Also, since the resulting comparison is not used for any intended purpose, it appears to be only a starting point for future application. For these reasons, claims 41 and 42 are considered to be non-statutory.

Independent claim 19, and consequently dependent claims 20-24, are also rejected under 35 U.S.C. 101 as being non-statutory because claim 19 only provides

coefficient manipulation for providing a process centre which is not considered to be a "useful, concrete and tangible result" but is instead a result of data manipulation.

Claims 47 and 48 present a computer readable medium containing software instructions. These software instructions are considered to be a data structure that does not define any functional interrelationships between the data structures and other claimed aspects of the invention which permit the data structure's functionality to be realized. It has been held that such a data structure is considered to be non-statutory under 35 U.S.C. 101 (See e.g., Warmerdam 33 F.3d at 1361. 31 USPQZd at 1760).

Further, apart from the utility requirement of 35 U.S.C. 101, usefulness under the patent eligibility standard requires significant functionality to be present to satisfy the useful result aspect of the practical application requirement (See Arrhythmia, 958 F.2d at 1057, 22 USPQ2d at 1036). Merely claiming nonfunctional descriptive material stored in a computer-readable medium does not make the invention eligible for patenting. For example, a claim directed to a word processing file stored on a disk may satisfy the utility requirement of 35 U.S.C. 101 since the information stored may have some "real world" value. However, the mere fact that the claim may satisfy the utility requirement of 35 U.S.C. 101 does not mean that a useful result is achieved under the practical application requirement. The claimed invention as a whole must produce a "useful, concrete and tangible" result to have a practical application. In the instant case, similar to claims 1 and 41 described above, claims 47 and 48 result in a final step of "comparing said at least one statistical quantity to

said control limit" which is not considered to be a "useful, concrete, and tangible" result.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1-8, 11-16, 19-23, 25-27, 33-35, and 47, as may best be understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Application Publication No. 2003/0055523 to Bunkofske et al. in view of U.S. Patent Application Publication No. 2002/0107858 to Lundahl et al. and U.S. Patent Application Publication No. 2005/0055175 to Jahns et al. and further in view of U.S. Patent No. 6,622,059 to Toprac et al.

Bunkofske discloses a method of monitoring a processing system for processing a substrate during the course of semiconductor manufacturing (0002 and 0048), comprising acquiring data from said processing system for a plurality of observations, said data comprising a plurality of data parameters/variables (0049 and 0052); constructing a principal components analysis (PCA) model from said data (0047), including centering and scaling (0056); determining at least one statistical quantity from said data using said PCA model (0043 and 0047); setting a

control limit for said at least one statistical quantity (0059); and comparing said at least one statistical quantity to said control limit (0059).

Bunkofske discloses detecting a process fault has occurred when said at least one statistical quantity exceeds said control limit (0059).

Bunkofske discloses that constructing said PCA model comprises determining one or more principal components of said data for said plurality of observations using principal components analysis (0012)

Bunkofske discloses that said plurality of data parameters comprises an instantaneous value of at least one of chamber pressure and RF power (0006).

Bunkofske discloses that said statistical quantity comprises at least one of a Q-statistic and a Hotelling T^2 parameter (0043).

Bunkofske further discloses a controller as part of a process performance monitoring system coupled to a process tool, inherently operating in accordance with a program stored on computer readable medium, for carrying out the method as well as coupled to a plurality of sensors attached to the process tool for acquiring the data (0019 and 0049).

As noted above, Bunkofske teaches many of the features of the claimed invention and while Bunkofske does explicitly disclose that the measurement data used for constructing a principle components analysis "is scaled and centered and a correlation matrix is calculated" (0056), the disclosure of Bunkofske does not provide details regarding this process.

Lundahl teaches a method and system for the dynamic analysis of data using principal components analysis (0065) and further teaches the well-known method of performing centering and scaling comprising applying centering coefficients to each of a plurality data parameters by subtracting centering coefficients from each of said data parameters and applying scaling coefficients to each of a plurality of data parameters by dividing each of said data parameters by said scaling coefficients (0059 and 0060).

It would have been obvious to one having ordinary skill in the art to modify the invention of Bunkofske to include the scaling and centering method of Lundahl because the combination would have provided the well-known method for carrying out the centering and scaling in a conventional manner as required in the method of Bunkofske (0059 and 0060).

Further, while the invention of Bunkofske and Lundahl does teach many of the features of the claimed invention including applying centering coefficients to each of a plurality of data parameters in a PCA model, wherein the centering coefficients are determined based on the data from the processing system, the combination does not specify that the method acquire additional data from the processing system after constructing the PCA model to form adjusted data and adjusted centering/scaling coefficients.

Jahns teaches industrial process fault detection using principal component analysis comprising acquiring initial data from a processing system (0009, lines 1-6) for a plurality of observations said initial data comprising a plurality of data

parameters (0011, lines 1-4 and 0035, lines 6-21), constructing a principal components analysis model from the data parameters (0011, lines 5-14), acquiring additional data from the processing system after construction of the PCA model and producing updated data matrices and updated models using both previous run data from the initial data and current data obtained as the additional data (0044, lines 10-16 and 0046, lines 6-10).

It would have been obvious to one having ordinary skill in the art to modify the invention of Bunkofske and Lundahl to specify that the method acquire additional data from the processing system after constructing the PCA model to form adjusted data and adjusted centering/scaling coefficients, as taught by Jahns, because the invention of Bunkofske and Lundahl teaches processing the acquired data from the processing system to form centering and scaling coefficients and Jahns suggests that the combination would have improved the overall analysis of Bunkofske and Lundahl by providing real time updating of the data from the system thereby keeping the process data and scaling/centering coefficients accurate to detect an abnormal process faster and reduce the number of products exposed to the abnormal process (0009, line 1 to 0010, line 5).

As noted above, Bunkofske in combination with Lundahl and Jahns teaches many of the features of the claimed invention and while the invention of Bunkofske, Lundahl, and Jahns does teach adjusting the centering coefficients utilizing both previous run data from said initial data and current data obtained from the additional observation, the combination does not specify that the adjustment is done at the

time of each observation of the additional data. Additionally, while the invention of Bunkofske, Lundahl, and Jahns does teach generating centering and scaling coefficients which are determined based on updated process data, and therefore also updated, the combination does not specifically provide the method for updating the centering coefficient.

Toprac teaches an automated process monitoring and analysis system for semiconductor processing comprising acquiring data from said processing system for a plurality of observations, said data comprising a plurality of data parameters (column 4, lines 9-23), constructing a principal components analysis (PCA) model from said data (column 10, lines 46-51), acquiring additional data from said processing system, said additional data comprising an additional observation (i.e. current measurement) of said plurality of data parameters, obtaining a mean of the data parameters, and adjusting the mean of the data parameters to form an updated mean at the time of each additional observation (column 18, lines 27-46).

Toprac teaches that adjusting the mean of the data parameters comprises updating the mean of the data parameters for each data parameter by combining an old value of the mean for each data parameter and a current value of each data parameter for said additional observation, wherein said old value comprises a mean value of the data parameter during said plurality of observations (column 18, lines 27-46).

Toprac further teaches that combining said old value of said adaptive mean and said current value of said data parameter for said additional observation comprises

applying an exponentially weighted moving average filter (column 18, lines 27-46) as well as setting a weighting factor to any value ranging from 0.0 to 1.0 as appropriate based on an amount of confidence (column 18, lines 47-53).

It would have been obvious to one having ordinary skill in the art to modify the invention of Bunkofske, Lundahl, and Jahns to specify the adjustment is done at the time of each observation of the additional data, as taught by Toprac, because, as suggested by Toprac and recognized by one having ordinary skill in the art, the combination would have improved the response time of the adaptation of Bunkofske, Lundahl, and Jahns by updating the coefficients each time a new observation is obtained, thereby insuring that accurate results are consistently determined and provided (column 18, lines 27-46) and further reducing the number of products exposed to the abnormal process, as desired by Jahns (Jahns; 0009, line 1 to 0010, line 5)

It would have been obvious to one having ordinary skill in the art to modify the invention of Bunkofske, Lundahl, and Jahns to specify the method for updating the centering coefficient, as taught by Toprac, because the invention of Bunkofske, Lundahl, and Jahns does teach generating the centering coefficient as a mean of consistently updated process data wherein the process data is obtained by a moving calculation (i.e. erasing the earliest scan and adding the newest) (Jahns, 0059, lines 1-10) and Toprac suggests that the combination would have provided a corresponding method for updating the centering coefficient/mean that would have improved the centering performed by Bunkofske, Lundahl, and Jahns by applying a

centering coefficient that is consistently updated and weighted based on confidences corresponding to the data obtained (column 18, lines 47-53).

6. Claim 9, 10, 24, 28, and 36, as may best be understood, is rejected under 35 U.S.C. 103(a) as being unpatentable over Bunkofske et al. in view of Lundahl et al., Jahns et al., and Toprac et al. and further in view of U.S. Patent No. 5,796,606 to Spring.

As noted above, Bunkofske in combination with Lundahl, Jahns, and Toprac teaches many of the features of the claimed invention, and while the invention of Bunkofske, Lundahl, Jahns, and Toprac does teach generating centering and scaling coefficients which are determined based on updated process data, and therefore also updated, the combination does not specifically provide the method for updating the scaling coefficient.

Spring teaches a process information and maintenance system for distributed control systems including means for obtaining data and from the data calculating/filtering a standard deviation using an exact recursive standard deviation employing an old value of the standard deviation, a current value of additional data, an old value of a mean, and a constant (column 6, line 41 to column 7, line 8).

It would have been obvious to one having ordinary skill in the art to modify the invention of Bunkofske, Lundahl, Jahns, and Toprac to specify the method for updating the scaling coefficient, as taught by Spring, because the invention of Bunkofske, Lundahl, Jahns, and Toprac does teach generating the scaling

coefficient as a standard deviation of consistently updated process data wherein the process data is obtained by a recursive calculation (i.e. erasing the earliest scan and adding the newest) (Jahns, 0059, lines 1-10) and Spring suggests that the combination would have provided a corresponding method for updating the scaling coefficient/standard deviation that would have improved the scaling performed by Bunkofske, Lundahl, Jahns, and Toprac by applying a scaling coefficient that is consistently updated and weighted based on a window that allows discounting of the oldest information using exponential-weighting-into-the-past (column 6, line 41 to column 7, line 8).

Further since the invention of Spring performs recursive standard deviation employing an old value of the standard deviation, a current value of additional data, an old value of a mean, and the invention of Bunkofske, Lundahl, Jahns, and Toprac defines the standard deviation as a scaling coefficient and the mean value as a centering coefficient, the combination performs recursive standard deviation employing an old value of the scaling coefficient, a current value of additional data, an old value of the centering coefficient.

7. Claims 17, 18, 29-32, 37-42, and 48, as may best be understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Bunkofske et al. in view of Lundahl et al., Jahns et al. and Toprac et al., and further in view of U.S. Patent Application Publication No. 2003/0144746 to Hsiung et al.

As noted above, Bunkofske in combination with Lundahl, Jahns, and Toprac teaches many of the features of the claimed invention and while the invention of Bunkofske, Lundahl, Jahns, and Toprac does teach acquiring many types of data, including adaptive scaling coefficients, the combination does not specifically include obtaining the many types of data via at least one of an intranet and an internet from a second process.

Hsiung teaches control for an industrial process using one or more multidimensional variables comprising a first industrial process connected to a second industrial process and/or server via an internet for accessing data (0036, 0040, and 0045) wherein the data is used in performing principal component analysis (0066 and 0106).

It would have been obvious to one having ordinary skill in the art to modify the invention of Bunkofske, Lundahl, Jahns, and Toprac to specifically include obtaining the many types of data via at least one of an intranet and an internet from a second process, as taught by Hsiung, because, as suggested by Hsiung, the combination would have improved the overall analysis of the first process by validating the many types of data by comparison with the same data from a similar process (0036).

Response to Arguments

8. Applicant's arguments with respect to claims 1-42, 47, and 48 have been considered but are moot in view of the new ground(s) of rejection.

The following arguments, however, are noted:

Applicant argues:

> Furthermore, the feature added to Claim 1 is similar to the "for each data parameter" recited in Claim 2 that was rejected over Toprac et al. As discussed during the interview, Jahns et al update the process model after every 50 new scans. To modify Jahns et al to update at the time of each observation of the additional data (i.e. for each data parameter) would teach away from Jahns et al.
>
> Moreover, the data shown in Figures 4A-4B of Jahns et al shows two aspects pertinent to whether one of ordinary skill in the art would have been motivated at the time of the invention to modify Jahns et al. First, the standard deviation shows little drift in Figure 4A and a slow progressive drift in Figure 4B. These slow drifts would not require that the process in Jahns et al be updated for each data parameter in order to properly control the process. Second, both sets of data in Figures 4A and 4B show anomalous data spikes. If one of ordinary skill in the art were to modify Jahns et al to update the model for each data point, the update following the anomalous point would produce an anomalous process control model and render Jahns et al unsatisfactory for its intended purposes.

The Examiner asserts that the proposed modification of Jahns with Toprac would not render Jahns unsatisfactory for its intended purpose because updating the model for each data point would still produce the dynamically updated model displayed in Figure 4A, however, the model would be updated after each point rather than after 50 scans.

Further, the Examiner notes that while Jahns does update after 50 scans as an example, Jahns does broadly indicate that the update is performed when new data is available and that the condition for recalculating the matrix (i.e. Um), while described as 50, can be set by the user. Therefore, Jahns does anticipate that a user may want perform the recalculation after a different numbers of scans, specifically:

> The sample matrices are representative of OES data expected from a wafer in which the identified plasma process has proceeded as expected. One or more of the sample matrices may be updated by the model building/updating sub-

module 102 when more OES data becomes available as additional wafers are processed.(0035, lines 24-29)

As may be appreciated, the conditions required in step 310 may differ (e.g., when a third or a quarter of the scans have been updated recalculation may be undertaken). If it is determined in step 310 that the conditions required to recalculate Um for each of the dynamic model matrices X3 and X4 are not met, then the plasma process fault detection module 100 proceeds to step 340. If it is determined in step 310 that the conditions required to recalculate the principal components for each of the dynamic model matrices X3 and X4 are met, then the plasma process fault detection module 100 proceeds to step 320. (0060, lines 16-27)

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to Applicant's disclosure.

U.S. Patent No. 5,949,678 to Wold et al. teaches a method for monitoring multivariate process comprising performing PCA by applying centering and scaling (column 11, lines 60-65) wherein the centering is performed using a EWMA filter and subtracting centering values to update the EWMA (column 12, lines 18-30) and scaling is performed by dividing the data set by a standard deviation wherein the standard deviation (i.e. scaling coefficient) is updated/adapted based on weighted local data (column 12, lines 31-42)

U.S. Patent No. 6,896,763 to Balasubramhanya et al. teaches a method and apparatus for monitoring a process by employing principal component analysis.

U.S. Patent No. 6,330,526 to Yasuda teaches a characteristic variation evaluation method of a semiconductor device.

U.S. Patent No. 6,675,137 to Toprac et al. teaches a method of data compression using principal components analysis.

U.S. Patent Application Publication No. 2002/0072882 to Kruger et al. teaches multivariate statistical process monitors.

Cherry et al., "Semiconductor Process Monitoring and Fault Detection Using Recursive Multi-Way PCA" teaches a method for quickly and accurately detecting faulty sensors or measurements in a semiconductor processing environment.

Shirazi et al., "A Modular Realization of Adaptive PCA" teaches an adaptive PCA algorithm which alleviates suboptimality of the PCA method for non-stationary signals.

Chatterjee et al., "Algorithms for Accelerated Convergence of Adaptive PCA" teaches an adaptive algorithm for PCA that is shown to converge faster than traditional PCA.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffrey R. West whose telephone number is (571)272-2226. The examiner can normally be reached on Monday through Friday, 8:00-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marc S. Hoff can be reached on (571)272-2216. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jeffrey R. West
Examiner – AU 2857

May 30, 2006